CLAIMS

We Claim:

1. An electrically isolated power transfer MEMS device for delivering electric power to a load, the device comprising:

a source generator including a movable member, wherein the source generator converts an electrical input signal to a displacement of the movable member;

a power transfer structure defining an input end in communication with the movable member that receives the displacement, and an output end opposite the input end that communicates the displacement, wherein at least a portion of the power transfer structure between the input and output ends is insulating;

an electrical generator disposed at a second end of the device receiving the displacement from the output end of the power transfer structure and, in response to the displacement, generates electrical power that is delivered to the load.

2. The device as recited in claim 1, wherein the insulated power transfer structure further comprises an elongated beam disposed between the source generator and the electrical generator.

3. The device as recited in claim 2, wherein the beam moves in response to the output of the source generator.

4. The device as recited in claim 3, wherein the electrical generator comprises an electrical loop having movable conductive arm in mechanical communication with the beam, wherein movement of the beam deflects the arm in the presence of a magnetic field to change the loop area and generate power for the load.

5. The device as recited in claim 4, wherein the electrical generator comprises a plurality of the movable arms connected in series.

6. The device as recited in claim 4, wherein the electrical generator comprises a plurality of the movable arms connected in parallel.

7. The device as recited in claim 3, wherein the electrical generator comprises a piezoelectric material that is in mechanical communication with the

beam, and wherein beam movement produces a force against the piezoelectric material to generate a voltage that is applied to the load.

8. The device as recited in claim 7, wherein the electrical generator comprises a plurality of the piezoelectric elements connected in series.

9. The device as recited in claim 7, wherein the electrical generator comprises a plurality of the piezoelectric elements connected in parallel.

10. The device as recited in claim 1, wherein the source generator comprises a Lorentz actuator including a movable arm in mechanical communication with the beam, wherein electrical current is supplied to the arm in the presence of a magnetic field to generate a force that displaces the movable member.

11. The device as recited in claim 10, wherein the Lorentz actuator receives the electrical power from a source that is selected from the group consisting of an ac source and a dc source.

12. The device as recited in claim 11, wherein the source is provided by the dc power source, wherein the generator further comprises a switch in electrical communication with the source to deliver pulses of electricity to the movable arm.

13. The device as recited in claim 1, wherein the source generator comprises an electrostatic generator having a set of capacitor plates including at least one movable plate that is in mechanical communication with the beam.

14. The device as recited in claim 13, wherein the capacitor plates receive electrical power from a source that is selected from the group consisting of: an ac source and a dc source.

15. The device as recited in claim 14, wherein the electrostatic generator draws power from the dc power source, and wherein the electrostatic generator further comprises a switch in electrical communication with the source to deliver pulses of electricity to the capacitor plates.

16. The device as recited in claim 13, wherein the electrostatic generator receives a voltage input from a piezoelectric actuator.

17. The device as recited in claim 13, wherein the electrostatic actuator receives a voltage input from a thermocouple.

18. The device as recited in claim 1, wherein the power transfer structure includes a lever having a first end pivotally attached to the substrate, and a second end opposite the first end, wherein the input end is disposed proximal the first end, and wherein the output end is disposed proximal the second end.

19. The device as recited in claim 1, further comprising a plurality of source generators connected to a common electrical input.

20. The device as recited in claim 1, wherein the power transfer structure oscillates during operation, further comprising compensation elements to maintain the oscillation of the power transfer structure at a resonant frequency.

21. The device as recited in claim 1, wherein the source further comprises a bi-morph.

22. In a MEMS device including a source generator, a power transfer structure in communication with the source generator, and an electrical generator in communication with the power transfer structure and further in electrical communication with a load, a method of transferring power from the source generator to the load, the method comprising the steps of:

generating an output at the source;

actuating the power transfer structure in response to the output, wherein at least a portion of the power transfer structure is insulating;

actuating the electrical generator to produce electrical power in response to step (b); and

delivering the electrical power produced in step (c) to the load.

23. The method as recited in claim 22, wherein the power transfer structure further comprises a movable beam that moves in response to actuation of the power transfer structure.

24. The method as recited in claim 23, wherein the electrical generator includes an electrical loop in the presence of a magnetic field, and wherein step (c)

further comprises moving the beam to change a loop area at the electrical generator to induce an electrical current.

25. The method as recited in claim 23, wherein the electrical generator includes a piezoelectric material in communication with the beam, and wherein step (c) further comprises moving the beam to exert a force against the piezoelectric material to produce a voltage that is applied to the load.

26. The method as recited in claim 22, wherein the electrical generator further comprises a plurality of power-producing elements connected in series.

27. The method as recited in claim 22, wherein the electrical generator further comprises a plurality of power-producing elements connected in parallel.

28. The method as recited in claim 22, wherein the source comprises a mass in mechanical communication with the power transfer device, and wherein step (b) comprises moving the MEMS device to actuate the mass.

29. The method as recited in claim 22, wherein the source includes a Lorentz actuator including a movable arm in mechanical communication with the power transfer device, and wherein step (a) further comprises applying an electrical current to the arm in the presence of a magnetic field to generate a force.

30. The method as recited in claim 22, wherein the source receives the electrical current from one of a piezoelectric actuator and a thermal actuator.

31. The method as recited in claim 22, wherein the source further comprises a switch, and wherein step (a) further comprises actuating the switch to deliver pulses of electrical power to the power transfer device.

32. The method as recited in claim 22, wherein the source includes an electrostatic generator having a set of capacitor plates including at least one movable plate that is in mechanical communication with the beam, and wherein step (a) further comprises receive electrical power at the capacitor plates.

33. The method as recited in claim 32, wherein the electrical power is received via one of a piezoelectric actuator and a thermal actuator.

34. An electrically isolated power transfer MEMS device for delivering electric power to a load, the device comprising:

a first generator disposed at a first end of the device that is capable of producing an output in response to a force;

an electrical generator disposed at a second end of the device receiving the output from the force generator and, in response to the output, is actuated to generate electrical power that is delivered to the load; and

an insulated power transfer structure disposed between the first generator and electrical generator that communicates the output of first generator to the electrical generator, thereby actuating the electrical generator.

35. The device as recited in claim 34, wherein the insulated power transfer structure further comprises an insulated elongated beam disposed between the source generator and the electrical generator.

36. The device as recited in claim 35, wherein the beam moves in response to the output of the source generator.

37. The device as recited in claim 36, wherein the electrical generator comprises an electrical loop having a movable conductive arm in mechanical communication with the beam, wherein movement of the beam deflects the arm in the presence of a magnetic field to change the loop area and generate power for the load.

38. The device as recited in claim 37, wherein the electrical generator comprises a plurality of the movable arms connected in series.

39. The device as recited in claim 37, wherein the electrical generator comprises a plurality of the movable arms connected in parallel.

40. The device as recited in claim 36, wherein the electrical generator comprises a piezoelectric material that is in mechanical communication with the beam, and wherein beam movement produces a force against the piezoelectric material to generate a voltage that is applied to the load.

41. The device as recited in claim 40, wherein the electrical generator comprises a plurality of the piezoelectric elements connected in series.

42. The device as recited in claim 40, wherein the electrical generator comprises a plurality of the piezoelectric elements connected in parallel.

43. The device as recited in claim 34, wherein the source generator comprises a mass in mechanical communication with the power transfer structure, and wherein vibration of the MEMS device actuates the mass to provide a displacement output.

44. The device as recited in claim 34, wherein the source generator comprises a Lorentz actuator including a movable arm in mechanical communication with the beam, wherein electrical current is supplied to the arm in the presence of a magnetic field to generate a force that is applied to the beam.

45. The device as recited in claim 44, wherein the Lorentz actuator receives the electrical power from a source that is selected from the group consisting of an ac source and a dc source.

46. The device as recited in claim 45 wherein the source is provided by one of a piezoelectric actuator and a thermal actuator.

47. The device as recited in claim 45, wherein the source is provided by the dc power source, wherein the generator further comprises a switch in electrical communication with the source to deliver pulses of electricity to the movable arm.

48. The device as recited in claim 34, wherein the source generator comprises an electrostatic generator having a set of capacitor plates including at least one movable plate that is in mechanical communication with the beam.

49. The device as recited in claim 48, wherein the capacitor plates receive electrical power from a source that is selected from the group consisting of: an ac source and a dc source.

50. The device as recited in claim 48, wherein the electrostatic generator draws power from the dc power source, and wherein the electrostatic generator further comprises a switch in electrical communication with the source to deliver pulses of electricity to the capacitor plates.

51. The device as recited in claim 34, wherein the source generator further comprises a piezoelectric member that receives an electrical input and provides the force that generates a displacement output.

52. The device as recited in claim 34, wherein the source generator receives the force and converts the force to an output displacement.

53. The device as recited in claim 34, wherein the generator produces the force and converts the force to an output displacement.

54. The device as recited in claim 34, wherein the generator further comprises an array of electrical generators connected in parallel.

55. The device as recited in claim 34, further comprises an array of electrical generators connected in series.